

AD-A093 872

AIR FORCE GEOPHYSICS LAB HANSCOM AFB MA  
HIGH-TIME RESOLUTION STUDY OF THE SEPTEMBER 21, 1977 SUDDEN COM--ETC(U)  
MAY 79 P F FOUGERE  
AFOL-TR-79-0105

F/G B/14

UNCLASSIFIED

NL

1-1



									END
									DATE
									FILED
									8 - 14
									DTIC

AD A093872

DDC FILE COPY

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

62101

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER <b>AFGL-TR-79-5155</b>	2. GOVT ACCESSION NO. <b>AD A093872</b>	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) <b>HIGH-TIME RESOLUTION STUDY OF THE SEPTEMBER 21, 1977 SUDDEN COMMENCE- MENT USING AFGL MAGNETOMETER DATA.</b>		5. TYPE OF REPORT & PERIOD COVERED <b>Scientific. Interim report.</b>
6. AUTHOR(s) <b>Paul F. Fougere</b>		7. PERFORMING ORG. REPORT NUMBER
8. PERFORMING ORGANIZATION NAME AND ADDRESS <b>Air Force Geophysics Laboratory (PHG) Hanscom AFB Massachusetts 01731</b>		9. CONTRACT OR GRANT NUMBER(s)
10. CONTROLLING OFFICE NAME AND ADDRESS <b>Air Force Geophysics Laboratory (PHG) Hanscom AFB Massachusetts 01731</b>		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS <b>76010802</b>
11. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) <b>LEVEL</b>		11. REPORT DATE <b>15 May 1979</b>
12. DISTRIBUTION STATEMENT (of this Report) <b>Approved for public release; distribution unlimited.</b>		12. NUMBER OF PAGES <b>6</b>
13. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		13. SECURITY CLASS. (of this report) <b>Unclassified</b>
14. SUPPLEMENTARY NOTES		14a. DECLASSIFICATION/DOWNGRADING SCHEDULE
15. KEY WORDS (Continue on reverse side if necessary and identify by block number) Storm sudden commencement Travelling disturbance Magnetometer data Solar flare AFGL magnetometer network Fluxgate magnetometer Search coil magnetometer		
16. ABSTRACT (Continue on reverse side if necessary and identify by block number) An SSC, following a solar flare of importance 3B, is seen to travel across the AFGL Magnetometer Network from west to east. The disturbance flattens and decays of it propagates like a plane wave with the stations responding in order of their distance from the sub-solar point.		

OPTIC  
ELECTED  
JAN 16 1981  
D

HIGH-TIME RESOLUTION STUDY OF THE SEPTEMBER 21, 1977 SUDDEN  
COMMENCEMENT USING AFGL MAGNETOMETER DATA

by

Paul F. Fougere  
Air Force Geophysics Laboratory  
Hanscom AFB, MA 01731INTRODUCTION

In this paper the data of Knecht, Hutchinson, and Tsacoyeanes from the AFGL magnetometer network are used to study the sudden commencement of 21 September 1977. The network consists of seven stations producing digital information and returning it to a central collection point at AFGL in Bedford, MA. There are five northern stations at about 55° corrected geomagnetic latitude and roughly equally spaced across the country. From west to east they are in the states of WA, SD, MI, and MA. There are also two southern stations at about 40° CGL, in CA and FL, but the CA station had not been completed by September 1977 and the Wisconsin station was inoperative on 21 September.

Each station has identical instrumentation: a fluxgate magnetometer measuring X, Y, Z, once each second and a coil system measuring  $\dot{X}$ ,  $\dot{Y}$ , and  $\dot{Z}$ , five times each second ( $\dot{X} = dX/dt$ ). Z is vertical down, X is along a magnetic meridian pointing north, and Y is orthogonal to X and Z, measuring essentially the D element.

RESULTS

Figure 1 shows an ssc on day 7264, September 21, 1977, at about 2040 UT. Five stations are superimposed. In the X component (bottom panel) there is a sudden decrease followed by a much larger sudden increase. The Y component shows a small increase followed by a large decrease. On this time scale, the X and Y components show nearly simultaneous deflections.

Figure 2 zooms in on the same event in a slightly different format. Each panel shows a different station as indicated by the 2-character codes on the right side. The X component is plotted as a dotted line. Each point is a one second observation. Also shown is the X component as a solid line (actually 5 points/sec are plotted). Concentrating attention on the northern stations; WA, SD, MI, and MA, it is evident that the disturbance depicted is traveling across the country from west to east in the sequence WA, SD, MI, and MA. The numbers on the left-hand axis following the word "gamma" are the scale factors for X and  $\dot{X}$  respectively. Thus the distance between tick-marks is 23  $\gamma$  and 258 units of  $\dot{X}$ . At Washington,  $\Delta X$  between the minimum and maximum is over 50  $\gamma$ . Notice that X takes on an extreme value whenever  $\dot{X}$  passes through zero. This verifies that the zero for  $\dot{X}$  has been chosen correctly. Note that the disturbance is sharpest at WA and flattens out and attenuates as we go east.

Figure 3 shows Y and  $\dot{Y}$  in an identical format for the same event. In this case the disturbance in Y is smaller than that in X, with scale factors of 12  $\gamma$  for Y and 211 for  $\dot{Y}$ . Here again the disturbance is traveling from west to east and flattening out and decaying as it goes, in agreement with the corresponding results for X.

This particular ssc was produced by a very large solar flare of class 3B. Figure 4 gives the details and shows that the shock wave from the sun traveled with an average velocity of 714 km/sec.

Figure 5 shows the location of the stations in a plot looking down on the ecliptic plane over the north pole. Noon is at top and 1800 UT is on the left. It is the dusk side.

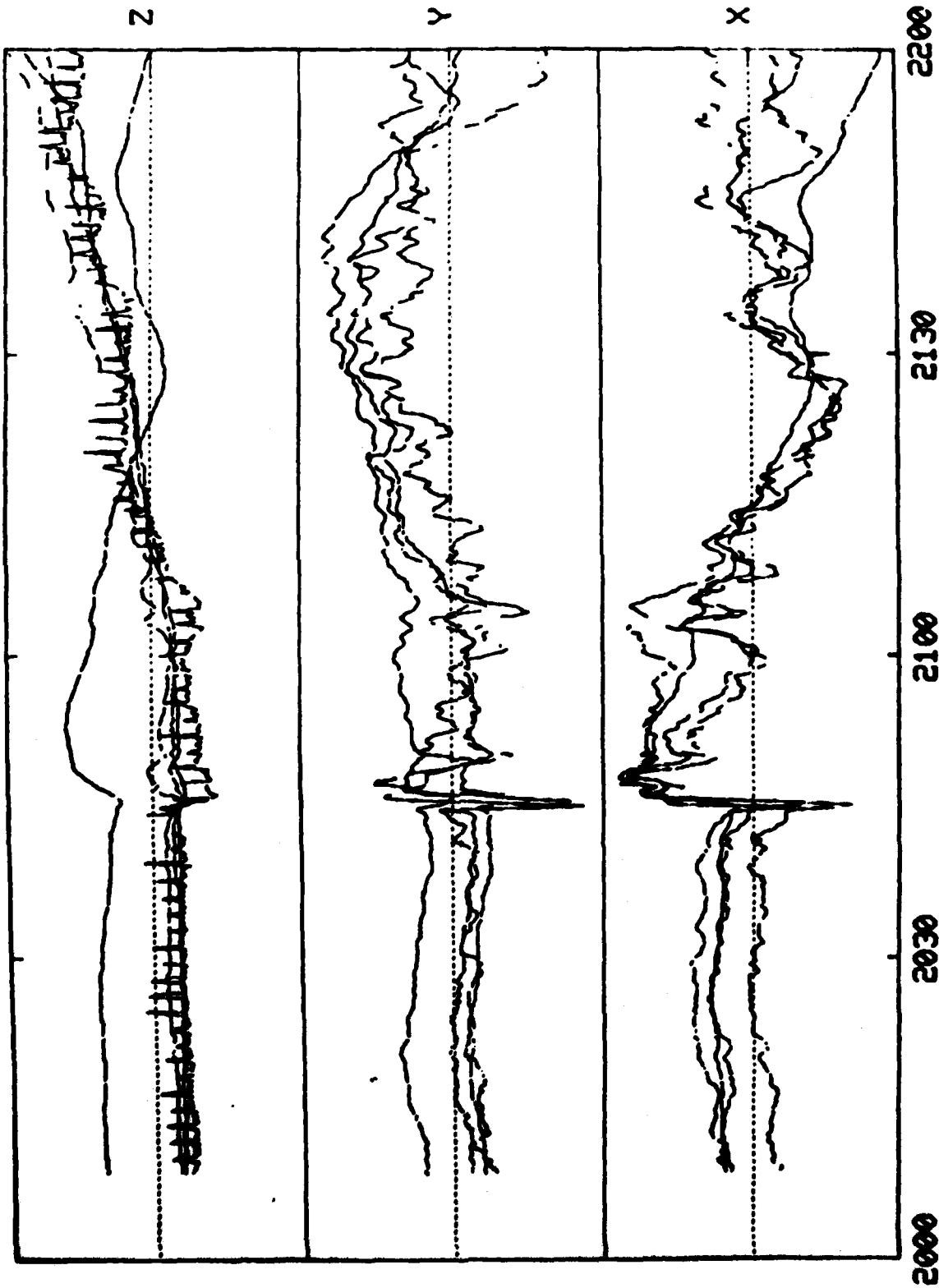
If the disturbance is sweeping across the earth from the sun, we might expect the stations to respond in the order of their distance from the sub solar point, that is WA, SD, FL, MI, and MA, that is, in an easterly direction exactly as observed.

The AFGL magnetometer network was constructed and is operated under the direction of David J. Knecht, Charles W. Tsacoyeanes, and Robert O. Hutchinson. Their cooperation is gratefully acknowledged.

Accession For	
DTIC	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
Distribution/	
Availability Codes	
Avail and/or	
Special	

7264

9/21/77



UNIVERSAL TIME

FIGURE 1

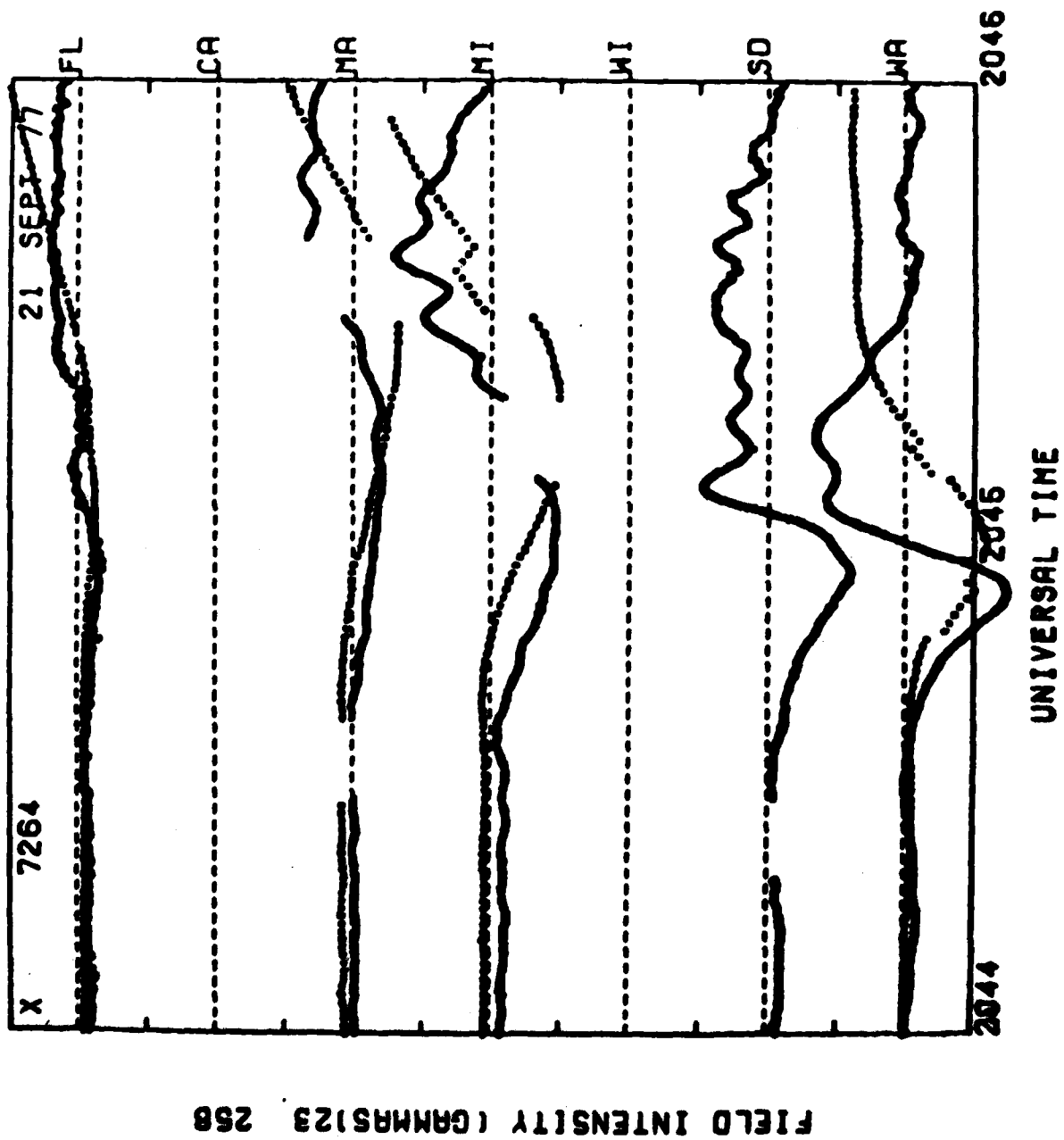
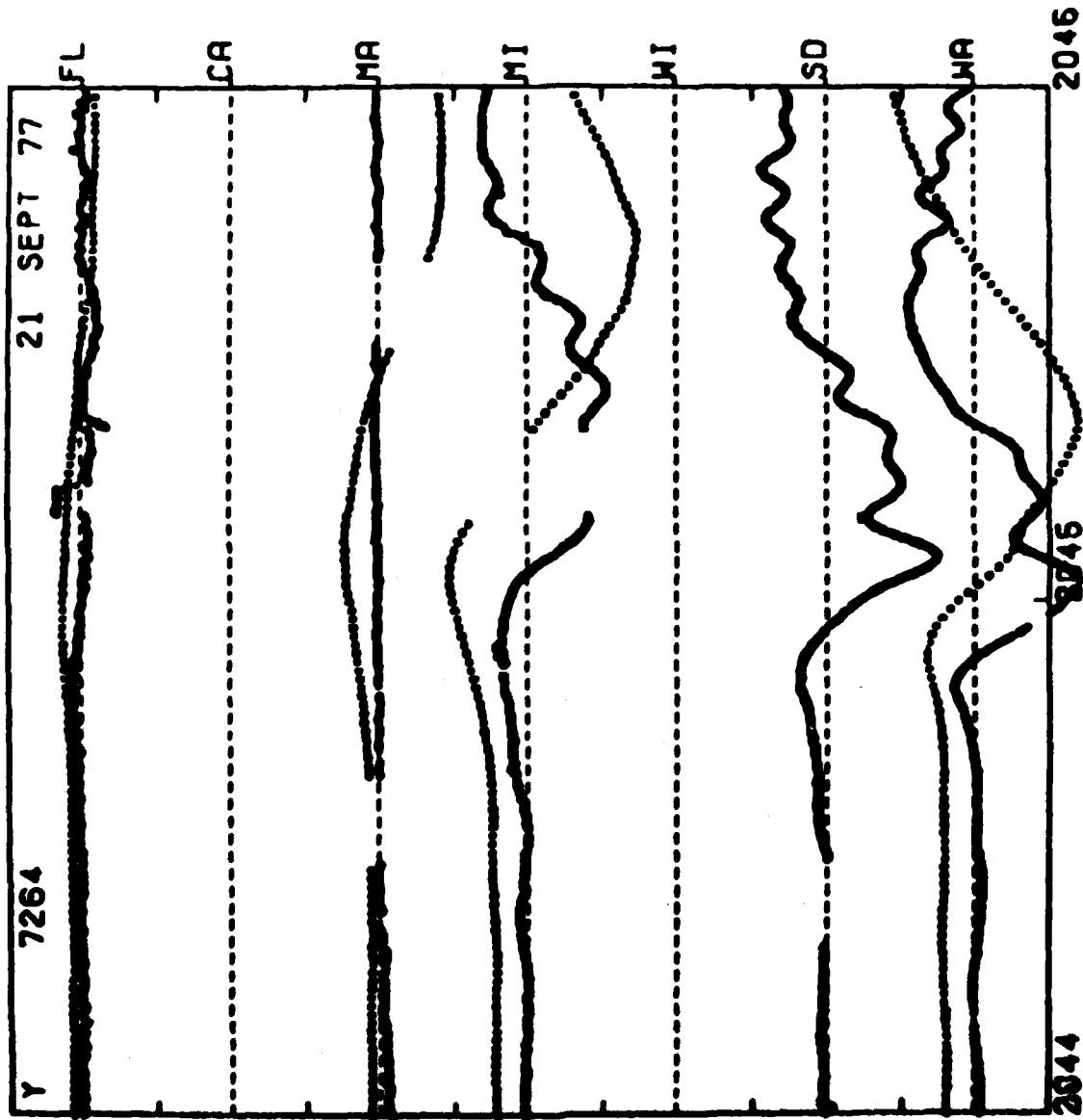


FIGURE 2

FIELD INTENSITY (GAMMAS) 12 211



UNIVERSAL TIME

FIGURE 3

3 B FLARE  
19 SEPT 1026Z  
REGION 889; N8; L = 197  
NEAR WEST LIMB

---

SSC 21 SEPT 2045Z  
 $\Delta T \sim 58.32 \text{ h}$

$$\therefore \text{MEAN VEL} \sim \frac{1.5 \times 10^8 \text{ km}}{58.32 \times 3600} =$$
$$\bar{V} \approx 714 \text{ km/sec}$$

FIGURE 4

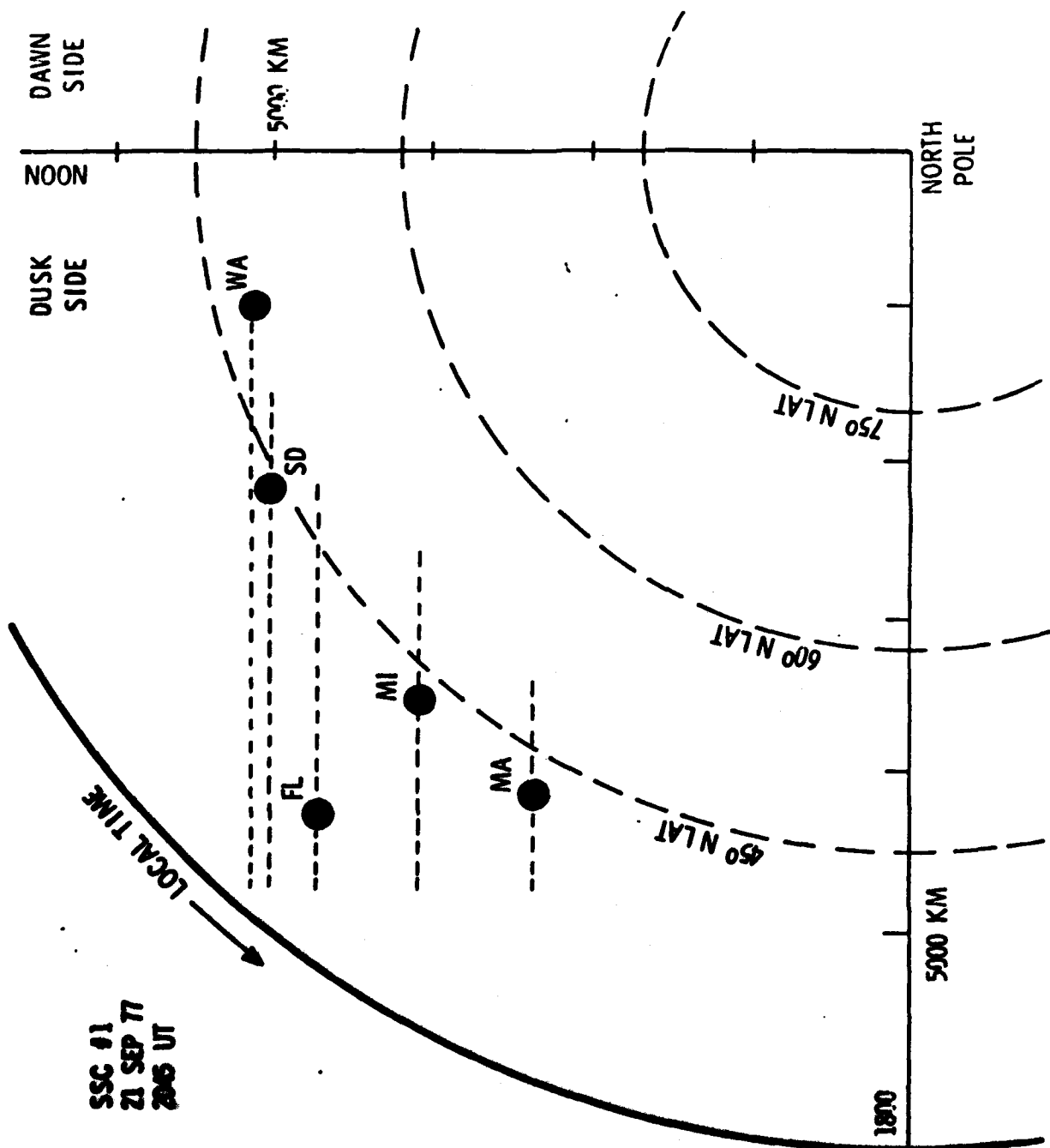


FIGURE 5